atitis, and other diseases transmitted by the fecal–oral route.

Personal and community responsibilities are critical. Individual, household, and community approaches to sustained access and proper use of safer water sources and improved sanitation facilities will depend on effective behavior change and communications strategies. In some places, ingrained cultural practices and a lack of education may be impediments. The political will of international, regional, national, and local authorities will need to be developed, exercised, and maintained. There is no quick fix for improved water and sanitation; achieving equity will be a long, hard road, but the human, economic, and societal results surely justify the investment and the effort.

These challenges — technological limitations, costs, behavioral customs, and lack of education and of political will — should be seen not as absolute barriers to moving forward but rather as problems to be solved. Similar objections have been raised before when bold programs have been proposed — for example, in regard to expanding access to antiretroviral treatment to poor people in developing countries. That effort, though still not completely successful, offers a model for providing safe water and improved sanitation. The ethical imperative of treating sick and marginalized people with medicines that are currently available to some but not to all is not so different from the imperative to provide all people with safe drinking water, sewage disposal, and food that is not contaminated by human feces. For now, they are available only to some.

Nothing said here has not been said before, often at greater length and depth.[5] But the message bears repeating, frequently and insistently. Cholera, rightly feared for both the terrifying loss of life it can cause and for the panic it incites in affected populations, is as much a symptom as a disease. It is a symptom of insufficient investment by the global development community in assuring access to safe water and improved sanitation — of providing only a Band-Aid solution to a difficult problem. Because fecal–oral transmission is the predominant means by which people contract cholera, the frequency of cholera cases in the 21st century reflects the indisputable fact that the current state of development leaves more than a billion of the poorest and most marginalized people at risk of ingesting feces with their food and water. As long as that is the case, it is difficult to be satisfied — notwithstanding the real successes that have been achieved — with the state of public health in developing countries.

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1. Cholera, 2011. Wkly Epidemiol Rec 2012; 87:289-304.
2. UNICEF/WHO Joint Monitoring Programme for Water Supply and Sanitation. Progress on drinking water and sanitation, 2012 update (http://www.unicef.org/media/files/JMPreport2012.pdf).
3. Mintz E, Bartram J, Lochery P, Wegelin M. Not just a drop in the bucket: expanding access to point-of-use water treatment systems. Am J Public Health 2001;91:1565-70.
4. Hutton G, Bartram J. Global costs of attaining the Millennium Development Goal for water supply and sanitation. Bull World Health Organ 2008;86:13-9.
5. Guerrant RL, Carneiro-Filho BA, Dillingham RA. Cholera, diarrhea, and oral rehydration therapy: triumph and indictment. Clin Infect Dis 2003;37:398-405.

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Use of Health IT for Higher-Value Critical Care

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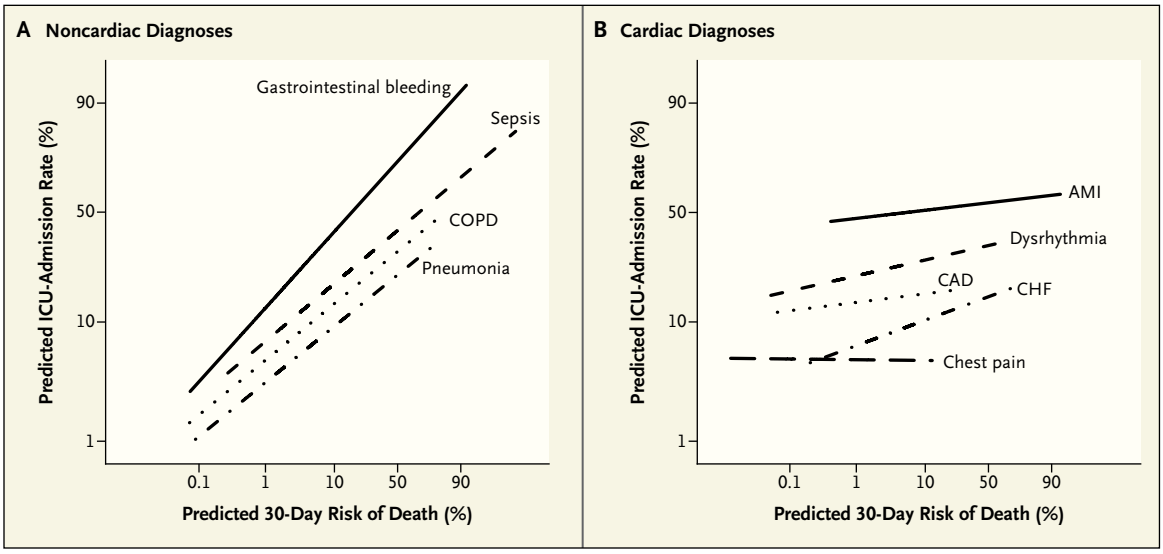
The patient had not yet coded but was spiraling downward, prompting a request for a bed in the intensive care unit (ICU). But the ICU had no available beds. Hours passed before the decision was made that another patient could safely be "bumped" out of the unit to accommodate our patient. After the transfer, in the empty room strewn with unused bottles, procedure kits, and hospital gowns, there was a moment of peaceful quiet but weariness. The team was exhausted from worrying that the patient would code before being transferred to the ICU, from running



Sensitivity of ICU-Admission Patterns to the Predicted Risk of Death among Patients.

Results are based on nine different logistic multilevel models (one for each condition), with a site-specific random intercept. The predictor was the predicted risk of death within 30 days after admission (defined according to the validated VA ICU score, which was based on laboratory data and coexisting conditions at the time of admission), and the outcome was ICU admission. The x and y axes are on a log-odds (or logit) scale. AMI denotes acute myocardial infarction, CAD coronary artery disease, CHF congestive heart failure, COPD chronic obstructive pulmonary disease, and ICU intensive care unit.

a makeshift ICU on a floor not equipped for it, and from knowing that other patients had been neglected in the interim.

This was not the first time that such a sequence of events had occurred — or the last time it would. Might things be done differently?

Just over half a century ago, hospitals opened ICUs with the explicit purpose of caring for the sickest patients, using the newest technology. Today, critical care in the United States costs more than $80 billion annually. About one in five Americans will die during a hospitalization that includes time spent in an ICU, and many more will use critical care services. With an aging population and ever-growing demand for critical care, some observers worry that the number of staffed ICU beds will become increasingly inadequate. In 2010, the Leapfrog Group found that nearly two thirds of surveyed hospitals did not meet standards for physician staffing in the ICU.[1]

In response to the shortage of intensivists, numerous strategies have been proposed. These include remote ICU telemonitoring and — as was recently recommended by the Society of Critical Care Medicine and the Society of Hospital Medicine — the critical care certification of hospitalists. Congress has taken notice as well: members proposed a bill (H.R. 971) to direct the Institute of Medicine and the Comptroller General to examine the effectiveness of ICU care and the supply of critical care physicians and beds.

Nevertheless, relatively little effort has been devoted to what could be the most promising approach to the problem: the application of advances in health information technology (HIT) to triage decisions. A few integrated health care systems such as the Veterans Affairs (VA) Healthcare System and Kaiser Permanente Northern California have already drawn on the ability of electronic health records (EHRs) to generate reliable estimates of the risk of death within 30 days for every patient on admission. Yet these calculations of risk, which may combine real-time data on laboratory results, demographics, coexisting conditions, and vital signs, are not being used to inform decisions about admission to the ICU. To accelerate progress in this area, we believe that more targeted incentives for meaningful use of HIT should be considered.

Currently, the Centers for Medicare and Medicaid Services offers financial incentives for hospitals to achieve meaningful use of HIT; such use includes implementation of clinical decision support interventions. However, what constitutes "meaningful" clinical decision support is loosely defined.

This absence of particulars has the advantage of giving hospitals maximum flexibility. Yet just as the explicit target of reaching the moon catalyzed space exploration, a few specific goals could accelerate HIT-related research in areas that are clinically pressing.

The triage of patients at the time of hospital admission is one such area ripe for study. Triage decisions frame the subsequent course of care for all hospitalized patients, yet in the case of critical care admissions, these decisions vary widely among hospitals,[2] which suggests that there is at least some misallocation of resources. Reliable, individualized, EHR-based predictions of risk have the potential to improve our ability to triage — and hence care for — patients.

To illustrate how data from a comprehensive EHR might contribute to better triage decisions, we examined the records of a cohort of 101,912 patients admitted for reasons other than surgery to 121 VA acute care hospitals in fiscal year 2009. Critical care guidelines continue to maintain that the ICU is the place to care for "the most seriously ill patients."[3] For the most common noncardiac diagnoses, we found that, in keeping with this guideline, patients with a high severity of illness were much more likely to be admitted to the ICU than were patients with a low severity of illness (see graph). In sharp contrast, for common cardiac diagnoses, severity of illness played a negligible role in ICU-admitting decisions.

Our findings have yet to be corroborated, but they add to evidence challenging the notion that scarce and costly critical care is reserved for the sickest patients. Some researchers have demonstrated that the severity of illness in ICU patients is dramatically higher in the United Kingdom than in the United States,[4] with as many as 40% of ICU patients in one national sample from the United States actually receiving no ICU-level interventions and having a low predicted risk of dying.[5]

It makes the most sense to use the ICU for the most seriously ill patients or those who stand to benefit the most from critical care and to harness the emerging power of the EHR across large health systems to evaluate how we can best use a very expensive and limited resource.

There are a number of potential explanations for our findings. Patients with cardiac illness may have a need for critical care that isn't captured by severity scores; however, the VA's ICU severity score is an excellent predictor of the 30-day risk of death, with areas under the receiver-operating-characteristic curve of 88% for patients with cardiac illness and 81% for those with noncardiac illness. We did not have data on patients' palliative care decisions, but it is hard to fully explain our findings on the basis of differential use of palliative care. It's possible that patients with cardiac illness are overrepresented in the population of ICU patients who need telemetry, were admitted to the ICU because of adherence to a protocol, or are awaiting transfer to another facility with interventional capabilities.

Physicians, too, may play a role. Doctors may perceive patients with cardiac illness as being at higher risk for sudden, unexpected deterioration. In combination with concern about medicolegal repercussions and available staffing and clinical expertise on non-ICU wards, this perception may propel physicians toward the routine admission to the ICU of relatively well patients with cardiac illness.

Although we have not provided an exhaustive list of possible explanations for our findings, taking care of the sickest patients is the only role that has been explicitly endorsed for the ICU. Use of the ICU for providers' convenience or peace of mind, as a temporizing measure for staffing problems, or as an all-purpose substitute for unavailable procedure or recovery rooms is unlikely to be an efficient use of valuable resources.

Our preliminary results, along with a growing body of related research, suggest that additional work is needed both to determine who benefits from critical care and to identify what indications for ICU use — other than severity of illness — have merit. A natural next step would be to examine whether ICU admission is associated with different condition-specific outcomes for low-

risk versus high-risk patients, after accounting for patient preferences.

Data from the EHR offer us the chance to reexamine and improve the value of critical care. Incentives for reaching HIT targets related to patient triage could accelerate the research and collaboration necessary to take full advantage of this opportunity. We believe it makes the most sense to use the ICU for the most seriously ill patients or those who stand to benefit the most from critical care and to harness the emerging power of the EHR across large health systems to evaluate how we can best use a very expensive and limited resource.

That, we believe, would truly be meaningful use of HIT.

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1. Factsheet: ICU physician staffing (IPS). Washington, DC: The Leapfrog Group (http://www.leapfroggroup.org/media/file/FactSheet_IPS.pdf).
2. Chen LM, Render M, Sales A, Kennedy EH, Wiitala W, Hofer TP. Intensive care unit admitting patterns in the Veterans Affairs health care system. Arch Intern Med 2012; 172:1220-6.
3. What is the purpose of an intensive care unit? New York: American Thoracic Society (http://www.thoracic.org/clinical/critical-care/patient-information/general-information/what-is-the-purpose-of-an-intensive-care-unit.php).
4. Wunsch H, Angus DC, Harrison DA, Linde-Zwirble WT, Rowan KM. Comparison of medical admissions to intensive care units in the United States and United Kingdom. Am J Respir Crit Care Med 2011;183:1666-73.
5. Lilly CM, Zuckerman IH, Badawi O, Riker RR. Benchmark data from more than 240,000 adults that reflect the current practice of critical care in the United States. Chest 2011;140:1232-42.

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